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Delayed Cholecystectomy After ERCP in Geriatric Patients: Balancing Surgical Risk and Recurrence Prevention — A Retrospective Study

Wannakorn Prapasajchavet, Vichit Viriyaroj, Hariruk Yodying, Thammanij Rookkachart, Suun Sathornviriyapong, Thana Boonsinsukh

Department of Surgery, Faculty of Medicine, Srinakharinwirot University, Nakhon Nayok, Thailand

Correspondence: Thana Boonsinsukh, Department of Surgery, Faculty of Medicine, Srinakharinwirot University, 62 Moo 7 Ongkharak, Nakhon Nayok, 26120, Thailand, Email thanab@g.swu.ac.th

Background: Laparoscopic cholecystectomy (LC) is commonly recommended following endoscopic retrograde cholangiopancreatography (ERCP) to reduce the risk of recurrent biliary events (RBE). However, in geriatric patients, this strategy remains controversial due to increased surgical risk, comorbid conditions, and decreased physiologic reserve. This study aimed to evaluate the outcomes of delayed LC in geriatric patients after ERCP for bile duct stone removal, emphasizing the role of individualized treatment planning.
Methods: We retrospectively reviewed medical records of patients aged ≥75 years who underwent ERCP at Her Royal Highness Princess Maha Chakri Sirindhorn Medical Center, Srinakharinwirot University, from January 2018 to December 2023. Patients were grouped based on whether they underwent delayed LC (>6 weeks post-ERCP). Clinical characteristics, RBE incidence, and mortality were analyzed. Multivariate logistic regression was used to identify predictors of RBE.
Results: Of 152 geriatric patients (mean age 82.3 years; 48% male), 53.3% had an ASA score ≥3, and the mean Charlson Comorbidity Index was 4.8. Delayed LC was performed in 34.2% of patients. RBE occurred in 8.6% overall, with a median onset of 390 days. The incidence of RBE was significantly lower in patients who underwent delayed LC compared with those managed without surgery (3.8% vs 11.0%, $p = 0.035$). RBE-related mortality was 0.7%, and surgery-related mortality was 1.9%. Multivariate analysis identified age ≥82 years as the only independent predictor of RBE (OR 5.7, 95% CI 2.15–25.05, $p = 0.014$).
Conclusion: Subsequent LC should be considered in geriatric patients to reduce the risk of RBE after ERCP. However, given the low rates of RBE and mortality observed, a wait-and-see strategy may be a reasonable alternative in selected high-risk patients. Treatment decisions should be individualized, considering each patient's comorbidities, surgical risk, and overall health status.
Keywords: delayed cholecystectomy, bile duct stone removal, geriatric patients, recurrent biliary events, shared decision-making

Introduction

The preferred approach for managing common bile duct (CBD) stones is endoscopic retrograde cholangiopancreatography (ERCP), especially when combined with sphincterotomy and bile duct clearance. However, patients undergoing ERCP without subsequent cholecystectomy have been reported to face a 17–45% risk of recurrent biliary events (RBE), including cholangitis, pancreatitis, cholecystitis, and recurrent CBD stones.[1–4] To mitigate recurrence and improve long-term outcomes, laparoscopic cholecystectomy (LC) is broadly recommended as definitive treatment.

The safety and efficacy of cholecystectomy in elderly patients remain debated. Some studies suggest that age alone should not contraindicate surgery, while others associate advanced age with increased perioperative risks.[5–11] Recent large-scale studies and meta-analyses have demonstrated that LC can be performed safely in selected elderly patients, although morbidity and mortality rise significantly beyond 80 years of age.[12–15] Data on super-elderly patients (≥90 years) further show higher rates of complications, conversion, and mortality.[16] Consistent with recent literature, we adopted 75 years as a practical cutoff, as this threshold has been frequently used in prior studies to reflect epidemiologic burden and higher perioperative risk in this age group, with outcomes likely modulated by geriatric frailty.[17–19]

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For geriatric patients with significant frailty or multiple comorbidities, a conservative strategy may be more appropriate than routine surgical intervention. A wait-and-see approach—deferring cholecystectomy while monitoring for clinical symptoms—has been proposed as a viable and pragmatic alternative in high-risk individuals. Notably, some evidence suggests that newly formed bile duct stones may spontaneously migrate into the duodenum following sphincterotomy, potentially reducing the risk of recurrent biliary events (RBE) without the need for immediate surgery.[20,21] This physiologic mechanism supports a non-operative approach in carefully selected patients, particularly those with limited physiologic reserve or reduced surgical tolerance.

In this context, clinical decisions should not rely solely on guideline-based algorithms but rather on a nuanced evaluation of each patient's overall health, functional reserve, and individual preferences. The objective of this study was to assess the outcomes of delayed LC following ERCP in geriatric patients, focusing on the incidence of RBE, mortality, and associated clinical predictors, with an emphasis on informing personalized treatment strategies.

Materials and Methods

Patients and Study Design

A retrospective chart review was conducted using patient data from Her Royal Highness Princess Maha Chakri Sirindhorn Medical Center, Faculty of Medicine, Srinakharinwirot University, covering the period from January 2018 through December 2023. The study included patients aged 75 years and older with bile duct stones who underwent ERCP. Exclusion criteria included prior cholecystectomy before ERCP, early cholecystectomy (<6 weeks), persistent bile duct stones or biliary stents, and bile duct narrowing due to benign or malignant diseases. The primary outcome was defined as recurrent biliary events (RBE), including CBD stones, cholangitis, pancreatitis, and cholecystitis. Delayed cholecystectomy was defined as surgery performed more than six weeks after ERCP with complete CBD stone clearance. This threshold was selected based on prior evidence suggesting that the risk of conversion and postoperative complications increases beyond six weeks, likely due to adhesion formation and tissue maturation.[22,23] Ethical approval for this study was obtained from the Institutional Review Board of Srinakharinwirot University (approval number SWUEC-673054), dated October 14, 2024.

Treatment Protocol and Surgical Approach

A two-stage management protocol was applied: initial ERCP with sphincterotomy and stone extraction, followed by LC when appropriate. Imaging modalities such as ultrasound, CT, or MRI were used for diagnosis. Incomplete stone removal was managed with temporary biliary stenting and scheduled re-intervention within three months. Difficult stones were treated using lithotripsy, and surgical consultation was obtained when endoscopic clearance failed.

LC was recommended in patients with successful CBD stone clearance. For geriatric patients, the decision to proceed with surgery was individualized, based on comorbidities, anesthetic risk, surgical assessment, and patient preference. LC was performed using a standard laparoscopic technique, ensuring the Critical View of Safety prior to clipping and division. Intraoperative cholangiography (IOC) or intraoperative ERCP was used selectively at the surgeon's discretion (eg, unclear anatomy, suspected retained stones, CBD dilation, or abnormal liver tests). Neither modality was protocolized or used routinely during the study period. Conversion to open surgery was undertaken when necessary due to unclear anatomy or dense adhesions. Patients who deferred surgery were monitored at 3–6 month intervals with imaging and laboratory evaluations.

Data Collection

Demographic data and outcomes were collected, including age, gender, comorbidities (hypertension, dyslipidemia, diabetes mellitus, cardiovascular disease, kidney disease and liver disease), body mass index (BMI, kg/m^2), American Society of Anesthesiologist (ASA) physical status classification, and age-adjusted Charlson Comorbidity Index (CCI). Standardized geriatric functional scales were not prospectively recorded; therefore, we used the ASA class and the age-adjusted CCI as pragmatic proxies of functional vulnerability. Other variables included initial diagnosis (CBD stones, cholangitis, pancreatitis, or cholecystitis), follow-up duration, CBD diameter, number of cleared CBD stones, and characteristics of difficult CBD stones (eg, periampullary diverticulum, lithotripsy). Post-ERCP complications, including pancreatitis, bleeding, duodenal perforation, and cholangitis, were documented. Additionally, the presence of gallstones, contracted gallbladder on follow-up, the rate of subsequent LC, RBE (cholangitis, recurrent CBD stones, cholecystitis), and RBE-associated mortality were assessed. For patients who underwent LC, data collected included the time from ERCP to LC, operative time, conversion rate, length of hospital stay, LC-related complications (bleeding, bile duct injury, infection), recurrent CBD stones following LC, time from LC to RBE, and LC-associated mortality.

Statistical Analysis

All statistical computations were performed using IBM SPSS Statistics, version 23 (IBM Corp., Armonk, NY, USA). Demographic data were presented as means or median, standard deviation (SD), and percentage. Comparisons between groups were conducted using the independent sample *t*-test or Mann–Whitney *U*-test for quantitative variables, and a Chi-squared test or Fisher's exact test was used for categorical data. A p-value of <0.05 was considered statistically significant. An odds ratio (OR) with a 95% confidence interval (CI) that did not include 1.0 was also considered statistically significant. Clinical scales that showed statistical significance were further analyzed using receiver operating characteristic (ROC) curve analysis to determine the optimal threshold for RBE risk. The optimal cut-off point was determined by maximizing the Youden index (J = sensitivity + specificity − 1), which identifies the value that provides the best balance between sensitivity and specificity. In addition, the cumulative incidence of RBE was compared between patients with and without LC using Kaplan-Meier survival curves, with difference assessed by the Log rank test. To account for baseline imbalances, variables with p<0.1 in univariate analyses were entered into a multivariate logistic regression model to identify independent predictors of RBE. Propensity score matching was not applied due to the limited sample size.

Results

A total of 152 geriatric patients (mean age: 82.3 ± 5.2 years; 48% male) were included. The most common comorbidities were hypertension, dyslipidemia, and cardiovascular disease. Over half of the patients (53.3%) had an ASA score ≥3, with a mean age-adjusted Charlson Comorbidity Index (CCI) of 4.8 ± 1.3. Presenting diagnoses included acute cholangitis (52%), common bile duct (CBD) stones (45.4%), pancreatitis (2%), and cholecystitis (0.7%). The average follow-up period was 20.2 ± 20.3 months. Intraoperative findings from ERCP revealed an average CBD diameter of 11.8±4.1 mm, with complete CBD stone removal successfully achieved on the first attempt in 59.9% of cases. Periampullary diverticulum was observed in 36.2% of patients, and lithotripsy was required in 11.2% of cases. Post-ERCP complications included pancreatitis (4.4%), bleeding (2.5%), and duodenal perforation (1.3%). During follow-up, 27% of patients had no gallstones, and 13.8% had a contracted gallbladder. RBE occurred in 8.6% of patients, including episodes of cholangitis, recurrent CBD stones, and cholecystitis. RBE-related mortality was 0.7%, involving an 83-year-old male who developed hospital-acquired pneumonia (HAP), congestive heart failure and septic shock following cholecystostomy for cholecystitis. Patient characteristics are summarized in Table 1.

Table 1 Demographic Data (n = 152)

Characteristics	
Age (years; mean±S.D.)	82.3±5.2
Male (%)	73 (48)
- Medical condition (%) - Hypertension - Dyslipidemia - Diabetes Mellitus - Cardiovascular disease - Kidney disease - Liver disease	143 (94.1) 120 (78.9) 73 (48) 47 (30.9) 50 (32.9) 39 (25.7) 10 (6.6)

(*Continued*)

Table 1 (Continued).

Characteristics	
ASA score (%)	
- I	3 (2)
- II	68 (44.7)
- III	77 (50.7)
- IV	4 (2.6)
Age-adjusted CCI (mean±S.D.)	4.8±1.3
- Age-adjusted CCI ≥ 5 (%)	76 (50)
Body Mass Index (kg/m^2; mean±S.D.)	22.5±4
Initial diagnosis (%)	
- Cholangitis	79 (52)
- CBD stones	69 (45.4)
- Pancreatitis	3 (2)
- Cholecystitis	1 (0.7)
Follow-up (months; mean±S.D.)	20.2±20.3
CBD diameter (mm; mean±S.D.)	11.8±4.1
Periampullary diverticulum (%)	55 (36.2)
Lithotripsy (%)	17 (11.2)
Number of ERCP for clearance (%)	
- 1	91 (59.9)
- 2	38 (25)
- 3	17 (11.1)
- ≥4	6 (4)
Post-ERCP complication (%)	7 (4.6)
- Pancreatitis	4 (2.6)
- Bleeding	2 (1.3)
- Duodenal perforation	1 (0.7)
Absence of gallstones (%)	41 (27)
Contracted gallbladder (%)	21 (13.8)
Underwent LC (%)	52 (34.2)
Recurrent biliary events (%)	13 (8.6)
- Cholangitis	6 (4)
- Recurrent CBD stones	4 (2.6)
- Cholecystitis	3 (2)
Time from ERCP clearance to recurrent biliary events (days; median, range)	390 (61–1,825)
Mortality (%)	1 (0.7)

Abbreviations: ASA, American society of anesthesiologists; CCI, Charlson comorbidity index; CBD, common bile duct; ERCP, endoscopic retrograde cholangiopancreatography; LC, laparoscopic cholecystectomy; S.D., standard deviation.

Univariate analysis identified two significant predictive factors for RBE (Table 2): age (p = 0.007) and an age-adjusted CCI ≥ 5 (p = 0.042). No significant differences were observed between the two groups in terms of gender, dyslipidemia, BMI ≥ 25 kg/m², CBD diameter ≥ 10 mm, presence of periampullary diverticulum, requirement for lithotripsy, ERCP requiring more than one attempt for clearance, absence of gallstones, or presence of a contracted gallbladder during follow-up. An optimal age threshold for predicting recurrent biliary events (RBE) was identified using

Table 2 Comparison Between Patients with and Without Recurrent Biliary Events

Characteristics	Without RBE (n =139)	With RBE (n=13)	p-value
Age (years; mean±S.D.)	81.9±5.1	85.9±5	0.007
Male (%)	68 (48.9)	5 (38.5)	0.47
Age-adjusted CCI ≥ 5 (%)	66 (47.5)	10 (76.9)	0.042
Dyslipidemia (%)	69 (51.5)	5 (45.5)	0.7
Body Mass Index ≥ 25 kg/m^2 (%)	30 (22.9)	1 (9.1)	0.287
CBD diameter ≥10 mm (%)	114 (82)	13 (100)	0.094
Periampullary diverticulum (%)	49 (35.3)	6 (46.2)	0.434
Lithotripsy (%)	15 (10.8)	2 (15.4)	0.615
ERCP for clearance > 1 (%)	54 (38.8)	7 (53.8)	0.291
Absence of gallstones (%)	40 (28.8)	1 (7.7)	0.101
Contracted gallbladder (%)	22 (15.1)	0 (0)	0.131

Abbreviations: RBE, recurrent biliary events; CCI, Charlson comorbidity index; CBD, common bile duct; ERCP, endoscopic retrograde cholangiopancreatography; S.D.,standard deviation.

Receiver operating characteristic (ROC) curve analysis, with the cut-off selected to maximize both sensitivity and specificity. A threshold of 82 years (AUC = 0.712; 95% CI: 0.577–0.846, p = 0.012) demonstrated acceptable predictive accuracy, with a sensitivity of 84.6% and a specificity of 51.1% (Figure 1).

On multivariable logistic regression including age ≥82 years, age-adjusted CCI ≥5, CBD diameter ≥10 mm, and absence of gallstones, only age ≥82 years remained independently associated with RBE (OR 5.7, 95% CI 2.15–25.05, p=0.014); CCI ≥5 (p=0.227) and absence of gallstones (p=0.145) were not significant, and CBD diameter ≥10 mm showed a borderline association (p=0.093).

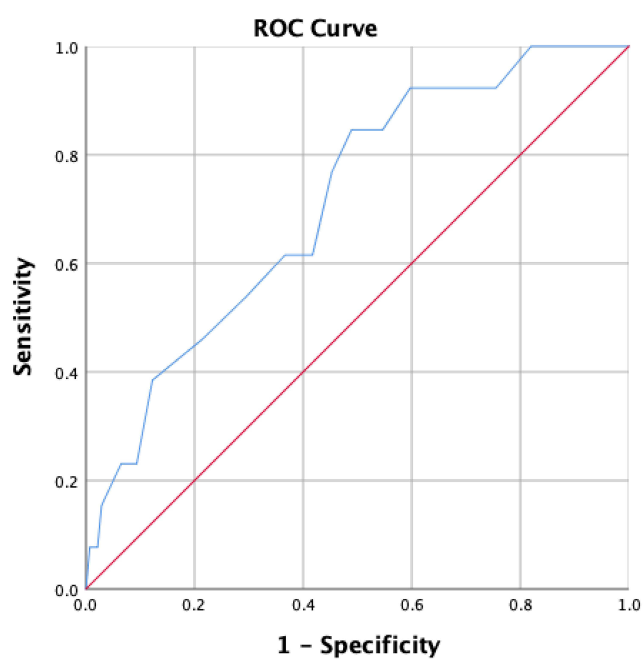

Figure 1 Receiver operating characteristic (ROC) curve for age in predicting recurrent biliary events (RBE). AUC = 0.712 (95% CI 0.577–0.846), p = 0.012.

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Following complete CBD stone removal, 34.2% of patients underwent LC. Operative and postoperative outcomes are summarized in Table 3. The median time from ERCP clearance to LC was 3 months, with a mean operative time of 88 minutes. Conversion to open surgery was required in 9.6% of cases, and the overall postoperative complication rate was 7.6%, including bleeding and bile duct injury. Recurrent CBD stones were observed in 3.8% of patients, with a median time to recurrence of 305 days. LC-related mortality was 1.9%, occurring in a 77-year-old female with preexisting cardiovascular disease who developed postoperative cardiac arrest.

Compared with patients without LC, those who underwent LC were younger, had lower rates of CCI ≥5, and were less likely to present with a contracted gallbladder or absence of gallstones, while no differences were noted in gender, ASA score, or comorbidity type (Table 4).

Time-to-event analysis of RBE following ERCP clearance revealed a median time to RBE of 390 days (range: 61–1825 days). Within 180 days, recurrence occurred in 1.3% of patients; 3.9% within 1 year; 6.6% within 2 years; and 8.6% within 5 years (Table 5).

Table 3 Operative and Postoperative Outcomes of Laparoscopic Cholecystectomy (n=52)

Characteristics	
Time from ERCP clearance to LC (months; median, range)	3 (2–60)
Operation time (min; mean±S.D.)	88.2±37.9
Conversion to open cholecystectomy (%)	5 (9.6)
Length of hospital stay (days; mean±S.D.)	5.3±2.9
Complication from LC (%) - Bleeding - Bile duct injury	4 (7.6) 2 (3.8) 2 (3.8)
Recurrent CBD stones following LC	2 (3.8)
Time from LC to recurrent biliary events (days; median, range)	305 (300–310)
LC-associated Mortality (%)	1 (1.9)

Abbreviations: ERCP, endoscopic retrograde cholangiopancreatography; LC, laparoscopic cholecystectomy; S.D., standard deviation; CBD, common bile duct.

Table 4 Comparison Between Patients with and without Laparoscopic Cholecystectomy

Characteristics	With LC (n=52)	Without LC (n =100)	p-value
Age (years; mean±S.D.)	80.4±4.5	83.2±5.2	<0.001
Male (%)	25 (48.1)	48 (48)	0.993
ASA score ≥ 3 (%)	26 (50)	55 (55)	0.558
Age-adjusted CCI ≥ 5 (%)	20 (38.5)	56 (56)	0.04
Medical condition (%)	51 (98.1)	92 (92)	0.132
Absence of gallstones (%)	5 (9.6)	36 (36)	<0.001
Contracted gallbladder (%)	2 (3.8)	19 (19)	0.01

Abbreviations: ASA, American society of anesthesiologists; CCI, Charlson comorbidity index; LC, laparoscopic cholecystectomy; S.D., standard deviation.

Table 5 Time-to-Event Analysis of Recurrent Biliary Events (RBE) Following ERCP Clearance (n=152)

Variables	Median Time, Days (Min-Max)	<180 Days	<365 Days	<2 Years	<5 Years
Recurrent biliary events	390 (61–1, 825)	2 (1.3)	6 (3.9)	10 (6.6)	13 (8.6)

Kaplan–Meier analysis of time to RBE, stratified by cholecystectomy status, demonstrated a significant difference between the two groups (Figure 2). The mean time to RBE was 60.34 months (SD = 5.88, 95% CI: 48.82–71.85) in patients without cholecystectomy, compared to 82.07 months (SD = 3.38, 95% CI: 75.45–88.68) in those who underwent cholecystectomy. This difference was statistically significant (Log rank test, p = 0.035).

Discussion

In patients who have undergone ERCP and clearance of CBD stones, cholecystectomy is recommended to reduce the risk of RBE, including recurrent CBD stones, cholangitis, cholecystitis, and pancreatitis. However, its role in older populations remains controversial due to the associated surgical risks.[12,16] Our study revealed an RBE rate of 8.6%, which is lower than the previously reported rates of 17% to 45% in the general population, most of which included younger patients. This discrepancy highlights potential age-related differences in RBE risk and aligns with prior reports questioning the universal need for routine cholecystectomy in geriatric patients.[1–3,15,17,20,24,25]

Comparison with previous studies reveals significant variation in reported RBE rates, with documented incidences ranging from 11% to 48% among elderly populations.[5,6,19,20] Kivivuori et al found that RBE occurred in 11% of patients aged 75 years or older, which is comparable to our findings.[18] However, some studies have reported higher rates, likely due to differences in patient selection criteria, follow-up durations, and definitions of RBE. Our patient selection was older compared to other studies, which typically start at 60–65 years. We focused on patients over 75 years due to their high surgical risk, making surgery rarely performed. Our follow-up duration is shorter than others due to the challenges associated with long-term follow-up in older patients, who often prefer not to visit the hospital. Another factor contributing to the variation in RBE rates across studies is the definition of RBE itself. Some studies included non-specific symptoms such as dyspepsia and colicky pain in their definitions, while our study only considered clinically significant events confirmed by imaging and laboratory findings. All of these factors may have contributed to our lower observed RBE rate.

The median time for elderly patients to develop RBE after ERCP ranges from 307 to 396 days.[1,18,19] Our findings fall within this range, with a median time of 390 days. Most RBE cases occurred within 1 to 2 years after endoscopic sphincterotomy and bile duct stone clearance, highlighting the critical need for close surveillance during this window. Similarly, Kivivuori et al reported that over half of the events took place within the first year after ERCP.[18] Although

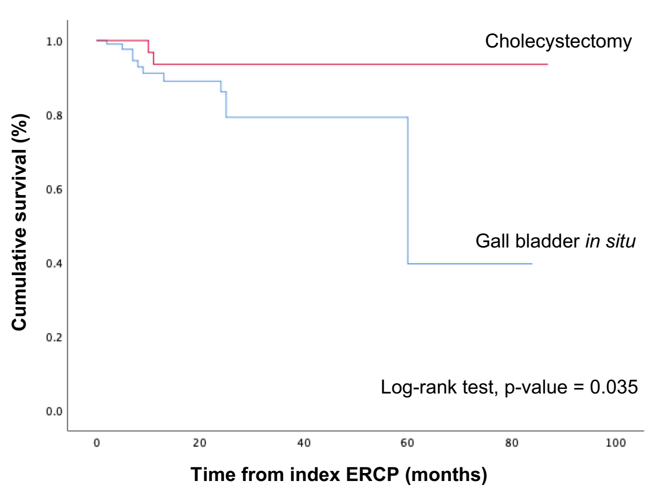

Figure 2 Kaplan–Meier estimates of time to recurrent biliary events (RBE).

RBE remains a concern, our study demonstrated a relatively low associated mortality rate of 0.7%, which is consistent with previous reports ranging from 0.3% to 0.9%.[6,18,20] These findings suggest that while RBEs may be clinically significant, they rarely result in life-threatening complications when managed appropriately in a geriatric population.

Previous studies have identified several risk factors for RBE following endoscopic bile duct clearance, including older age, common bile duct (CBD) dilation, use of mechanical lithotripsy, presence of a periampullary diverticulum (PAD), multiple ERCP procedures and gallbladder left in situ.[1,19,21,26–29] However, our study identified that older age was the only significant predictor of RBE, possibly due to the small sample size or differences in baseline patient characteristics.

The specific mechanism between age and RBE remains unclear, but geriatric patients may experience bile stasis or impaired bile flow, increasing the risk of recurrent biliary events. Additionally, they have more risk factors, such as CBD dilation and PAD, which are associated with the recurrence of stones.[28,29] These conditions may promote stone formation due to prolonged bile residence time. Although our study did not find these factors to be a statistically significant risk factor, it remains an important consideration in clinical practice.

Subsequent cholecystectomy is recommended for the prevention of further RBE. However, it remains a subject of debate among geriatric patients due to the high surgical risk, which is influenced by clinicians' decisions and the patients' own preferences. Our study found that patients who underwent LC were generally younger (80.4 vs 83.2 years) and had lower Charlson Comorbidity Index (CCI) scores, suggesting that surgeons selectively offer surgery to healthier patients. This likely reflects selection bias and aligns with large administrative datasets in octogenarians showing that functional dependence is strongly associated with adverse outcomes.

Previous studies indicate that cholecystectomy can be safe in well selected older adults, even with higher ASA scores, so surgery remains a viable option for some patients.[3,7,14] In contrast, other series report higher rates of hemorrhage, bile leakage, conversion, failure to achieve the critical view of safety, and longer stays in those aged 65 years or older, particularly when frailty is present; morbidity clustered in high frailty groups, and mortality in octogenarians reached 7.63% at 30 days and 25.69% at 2 years.[7–13,15–17,25,30] In our cohort, conversion and postoperative complications were 9.6% and 7.6%, with one death (1.9%), which underscores the need for careful selection. Some studies also question whether LC meaningfully reduces RBE, reporting 25% recurrence despite LC and no difference in time to recurrence compared with a wait-and-see approach in patients aged 75 years or older.[6,19,31] Therefore, equivalency cannot be inferred, and decisions should be individualized by operative risk and frailty. Importantly, the balance of risks and benefits is also influenced by institutional capacity and case mix. During the COVID-19 period, LC outcomes worsened; lack of qualified OR nurses independently predicted non-textbook outcomes.[32]

For elderly patients deemed unfit for surgery, alternative strategies should be considered. One option is performing a larger sphincterotomy or endoscopic papillary large balloon dilation (EPLBD). Studies suggest that extended sphincterotomy may lower RBE rates by improving bile drainage.[20,21] A larger sphincterotomy extended to the duodenal wall may offer greater protection by completely eliminating the common channel and providing a wider biliary outflow tract, facilitating the spontaneous passage of future stones.[20] Another approach is long-term surveillance with periodic imaging and liver function tests to detect early signs of RBE. In frail elderly patients, a "wait-and-see" strategy may be appropriate, given the low incidence of severe RBE-related complications. Some studies suggest that conservative management rarely leads to clinically significant consequences, particularly in patients with limited life expectancy.[6,18,19]

Optimal timing of LC after ERCP remains unsettled. Many studies favor early LC, preferably within the same admission or within 72 hours, reporting shorter hospital stays, less operative time, lower conversion rates, and fewer postoperative complications.[3,4,23,33,34] The risk of conversion appears to rise after six weeks, plausibly due to adhesion and tissue maturation; reported rates are 4% within 24 hours and 14% beyond six weeks.[22,23] Bergeron et al found that the median time to the first RBE was 34 days, with an incidence of 2.5% at 7 days and increasing to 53.3% at 1 year.[3] For these reasons, many studies advocate for early LC, especially within 72 hours after ERCP, to reduce re-admissions associated with RBE.[3,4,33–35] Conversely, several cohorts, including our prior data, found no consistent association between the interval from ERCP to LC and conversion, complications, or length of stay.[3,4,35–38] In our elderly cohort, most RBEs occurred 1 to 2 years after ERCP, later than in younger populations, which suggests that a modest delay may be acceptable when perioperative risk is high. Overall, early LC is a reasonable target when resources and patient condition permit, but in older or frail patients the timing should be individualized to frailty, comorbidity, patient preference, and local capacity, consistent with expert commentary that the priority is to get it right the first time.[39]

The findings of this study carry important clinical implications for the management of geriatric patients following ERCP. While LC should be considered to mitigate the risk of recurrent biliary events, it may not be necessary in all cases —particularly in patients with significant comorbidities or advanced frailty. A personalized, risk-based approach is essential, weighing the potential benefits of surgical prevention against the perioperative risks and long-term functional impact. For certain high-risk individuals, a conservative, wait-and-see strategy may offer an effective and pragmatic alternative, without substantially increasing morbidity or mortality. This strategy is particularly relevant for those with limited physiologic reserve, in whom the risks of surgery may outweigh its potential preventive gains. Given that most patients ≥75 years were managed conservatively due to high operative risk, our observations are best viewed as hypothesis-generating rather than definitive.

This study has several limitations that should be acknowledged. First, its retrospective design, relying on medical records and chart reviews, introduced potential biases and limitations in data completeness. Missing or incomplete information may have contributed to the relatively short follow-up period, potentially underestimating the true incidence of long-term RBEs and complications. Second, the age threshold of ≥75 years was clinically justified due to higher surgical risk, but it resulted in a smaller sample size, limiting statistical power and external validity. This also produced wide confidence intervals in the regression (eg, age ≥82 years, OR 5.7, 95% CI 2.15–25.05), reflecting the small number of RBE events. Third, potential selection bias should be considered, as healthier patients with fewer comorbidities may have been more likely to undergo surgery, potentially influencing the observed outcomes. Fourth, although ASA and CCI were recorded, the absence of standardized frailty assessments limited our ability to evaluate functional reserve and geriatric vulnerability, which are increasingly recognized as critical determinants of surgical risk. Lastly, the study was conducted in a single regional center, and demographic variations may affect the generalizability of the results to other populations and healthcare settings.

Future research should refine non-surgical management strategies and clarify which geriatric patients are most likely to benefit from conservative or surgical approaches. Incorporating objective geriatric assessment tools would further strengthen clinical decision making and support individualized care. Multicenter prospective studies with larger and more diverse populations are needed to validate these findings and establish evidence-based guidelines. Additional factors such as frailty, functional status, microbiome profiles and bile composition also warrant investigation. Evaluation of newer endoscopic techniques and long-term quality of life outcomes may further optimize care for high-risk elderly patients.

Conclusion

Subsequent laparoscopic cholecystectomy (LC) may offer clinical benefit in reducing the risk of recurrent biliary events (RBE) in geriatric patients following successful ERCP. However, given the overall low incidence of RBE and mortality observed in this population, a wait-and-see strategy may represent a reasonable and safe alternative, particularly for those with advanced age, frailty, or significant comorbidities. Ultimately, the decision to proceed with LC should be guided by a personalized assessment that incorporates surgical risk, functional status, and the individual goals and preferences of each patient.

Data Sharing Statement

Deidentified participant data and study documents will be available from the corresponding author (thanab@g.swu.ac.th) on reasonable request for 5 years after publication.

Ethics Approval and Consent to Participate

This study was approved by the Institutional Review Board of Srinakharinwirot University (approval number: SWUEC-673054) and conducted in accordance with the Declaration of Helsinki. The requirement for informed consent was waived by the ethics committee due to the retrospective nature of the study and the use of anonymized patient data.

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This study was registered with the Thai Clinical Trials Registry (TCTR) under the identification number TCTR20250117001. The registration details are publicly accessible at https://www.thaiclinicaltrials.org/show/TCTR20250117001.

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Disclosure

The authors declare that there are no conflicts of interest related to this work.

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